

CLAIMS

1. A method of treating a pipe having at least one gap or discontinuity on the interior surface thereof, the method including applying filling material to the gap or discontinuity so as to provide a generally smooth interior surface of the pipe at the region of the gap or discontinuity.
2. A method according to claim 1, wherein the pipe comprises a plurality of coupled sections and wherein the gap or discontinuity is formed at the region where respective adjacent sections are coupled.
3. A method according to claim 1, wherein the gap or discontinuity is created by deterioration of the pipe over time, such as by cracking or corrosion.
4. A method according to claim 1, wherein the gap or discontinuity is a redundant fluid passage.
5. A method according to claim 1 or 4, wherein the gap or discontinuity is a protrusion from the interior surface of the pipe.
6. A method according to any one of the preceding claims, wherein the filling material is applied such that it bridges across the gap or discontinuity but does not completely fill the gap or discontinuity.
7. A method of forming a pipe, including coupling a plurality of pipe sections, and treating the pipe according to the method of any one of the preceding claims.
8. A method according to claim 7, wherein the pipe sections are coupled by a spigot and socket joint.

9. A method according to claim 7, wherein the pipe sections are coupled by a welded joint.
10. A method according to claim 7, wherein the pipe sections are coupled a bolted gland joint.
11. A method according to claim 7, 8, 9 or 10, wherein the pipe sections are coupled by any method that creates an internal discontinuity.
12. A method according to claim 7 or 8, wherein a fluid seal is applied between the pipe sections.
13. A method according to claim 12, wherein the fluid seal is applied prior to applying the filling material.
14. A method according to claim 12 or 13, wherein the fluid seal is located further from the centre of the pipe than the filling material.
15. A method according to any one of the preceding claims, wherein the filling material is applied by spraying the filling material onto the interior surface of the pipe.
16. A method according to any one of the preceding claims, wherein the filling material is applied to a pre-joined or welded area of two pipes where a coating of the welded area is required to provide a continuous internal protective coating.
17. A method according to any one of the preceding claims, wherein the gap or discontinuity is a gap or discontinuity in an internal coating of the pipe, and

wherein the filling material is applied to the gap or discontinuity in the internal coating in order to provide a continuous internal coating.

18. A method according to any one of claims 1 to 14, wherein the filling material is applied by forming a cavity at the gap or discontinuity and supplying filling material to the cavity.

19. A method according to claim 18, wherein the cavity is formed by an inflatable bladder inflated within the pipe.

20. A method according to any one of the preceding claims, including applying a lining material over the interior surface of the pipe and the filling material.

21. A method according to claim 20, wherein the lining material is applied by spraying.

22. A method according to claim 20 or 21, wherein the lining material forms a cross-linked molecular structure.

23. A method according to claim 20, 21 or 22, wherein the lining material is a flexible polyurea.

24. A method according to any one of claims 20 to 23 when dependent on claim 12, wherein the fluid seal is applied prior to lining the pipeline.

25. A method according to any one of claims 20 to 23 when dependent on claim 12, wherein the fluid seal is applied after lining the pipeline.

26. A method according to any one of the preceding claims, wherein the filling material is a liquid, two-part resin system which sets substantially within one minute of the two parts mixing.
27. A method according to claim 26, wherein the first part of the resin system comprises polyisocyanate, optionally blended with a non-reactive plasticiser.
28. A method according to claim 26 or 27, wherein the second part of the resin system comprises one or more polyamines, optionally blended with one or more polyhydric alcohols (polyols) and/or a non-reactive plasticiser.
29. A method according to any one of the preceding claims, wherein the filling material comprises two components which set when combined, the method including combining the two components in a channel from which the combined components pass to the gap or discontinuity, and further including removing residue of said components from said channel after treating the gap or discontinuity with the filling material.
30. A method according to claim 29, wherein the residue is removed by a piston moving in said channel.
31. A method according to claim 30, wherein the residue removed by the piston completes the application of the filling material to the gap or discontinuity.
32. A method according to any one of the preceding claims, wherein the filling material comprises a plurality of components, each stored in respective reservoirs, and wherein the components are ejected from said reservoirs simultaneously.

33. A method according to claim 32, wherein the components are ejected from said reservoirs by movement of a piston in each of said reservoirs.
34. A method according to claim 33, wherein the respective pistons in each reservoir are coupled to one another and are moved by a common power source.
35. A method according to claim 34, wherein the common power source comprises an air or hydraulic actuator coupled to each of said pistons.
36. A method according to claim 18 or 19, wherein gas trapped in said cavity is released or compressed as said filler material is applied to the gap or discontinuity.
37. A method according to claim 36, wherein the gas is released through port means in said cavity.
38. A method according to claim 37, wherein the port means allows the passage therethrough of gas but not liquid.
39. A method according to claim 38, wherein the port means comprises a PTFE fabric membrane which allows air particles therethrough but not liquid particles.
40. A method according to claim 18, 19, 36, 37 or 38, including using information obtained from a camera in said cavity to locate the cavity with respect to the gap or discontinuity.
41. A method according to claim 40, wherein the camera has a diameter of 12mm or less.

42. Apparatus for lining a pipe having at least one gap or discontinuity therein, the apparatus comprising means for applying filling material to the gap or discontinuity, the arrangement being such that a generally smooth interior surface of the pipe is formed at the region of the gap or discontinuity.

43. Apparatus for lining a pipe having at least one gap or discontinuity in the interior surface thereof, the apparatus including means for applying filling material to the gap or discontinuity, and means of spraying a liner material over a region of the interior surface including the filling material.

44. Apparatus for lining a pipe having at least one gap or discontinuity therein, the apparatus comprising means for applying filling material to the gap or discontinuity, wherein the said means is operable to apply a low viscosity polymer, the arrangement being such that a generally smooth interior surface of the pipe is formed at the region of the gap or discontinuity.

45. Apparatus for lining a pipe having at least one gap or discontinuity therein, the apparatus including means for applying filling material to the gap or discontinuity so as to form a generally smooth interior surface of the pipe at the region of the gap or discontinuity, the applying means comprising a source of a first component of the filling material and a source of a second component of the filling material, a channel coupled to the respective sources for receiving the first and second components therefrom and in which the first and second components to cause the components to set, and a means for removing residue of said components from the said channel after application of the filling material to the gap or discontinuity.

46. The apparatus of claim 45, wherein the removing means comprises a piston reciprocable within the channel.

47. Apparatus for lining a pipe having at least one gap or discontinuity in an interior surface thereof, the apparatus comprising means for applying filling material to the gap or discontinuity so that a generally smooth interior surface of the pipe is formed at the region of the gap or discontinuity, a variety of reservoirs in which respective components of the filling material are stored, and means for ejecting the components from the respective reservoirs simultaneously in order to apply the filling material.

48. The apparatus of claim 47, wherein the ejecting means comprises a reciprocable piston of each of said reservoirs for urging the components stored therein to be ejected in metered quantities through an outlet of each of the reservoirs for application to the gap or discontinuity.

49. The apparatus of claim 48, including means for coupling together the pistons in the respective reservoirs, a power source, and coupling means for applying power from the said power source to each of the pistons.

50. The apparatus of claim 49, wherein said power source comprises an air or hydraulic actuator coupled to each of the said pistons.

51. Apparatus of lining of the pipe having at least one gap or discontinuity in the interior surface thereof, the apparatus including means for applying filling material to the gap or discontinuity so that a generally smooth interior surface of the pipe is formed at the region of the gap or discontinuity, wherein the applying means comprising a cavity positionable at the gap or discontinuity for receiving a supply of filling material, and means associated with the said cavity for allowing the release or compression of gas or liquids trapped in said cavity as said filling material is applied to the gap or discontinuity.

52. Apparatus of lining of the pipe having at least one gap or discontinuity in the interior surface thereof, the apparatus including means for applying

filling material to the gap or discontinuity so that a generally smooth interior surface of the pipe is formed at the region of the gap or discontinuity, wherein the applying means comprises a cavity positionable at the gap or discontinuity for receiving a supply of filling material, and a camera located at said cavity for providing images for locating the cavity with respect to the gap or discontinuity.